evidently been done. We have examined carefully a large number of the articles, and of course the scientific ones especially, and considering the purpose and plan of the work, there is really very little room for criticism. All the scientific articles have evidently been written by men who have special knowledge of their subjects, and as a rule are masterly specimens of condensation, clear statement, and wonderful fulness of information. Such names of contributors as Tait, Deutsch, Alex. Bain, Alex. Buchan, Goldstücker, Dr. G. E. Day, Keith Johnston, Dr. Birch, Pengelly, Francis Francis, and many others, are guarantees that in all the principal departments thoroughly competent men have been secured to write. But while with such contributors the quality of the information was bound to be up to the mark, the Encyclopædia would have suffered much in other respects without a thoroughly competent organising head. It is, no doubt, mainly due to Dr. Findlater that uniformity and due proportion have been secured, and that throughout perfect clearness has been maintained. His singular adaptation to fill the post of editor of such a work has largely contributed to its success.

But it is not only in the larger and more important articles that accuracy and care are apparent; even in the case of unimportant towns which may occupy only three or four lines, the information may be depended on, and in the case of British towns at least, was obtained, we believe, in almost every instance at first hand from some one on the spot. But down to the minutest details throughout the work constant and thoroughly intelligent and competent editorial care is evident, and if the Messrs. Chambers are careful to keep their work up to date, and bring out new editions at the proper times, they need hardly fear a rival.

The edition which lies before us is not strictly a new, but a revised edition; the work has not been reset, and but little increase has been made in the number of articles. We have, however, taken pains to compare some of the principal scientific articles in the new edition with the corresponding ones in the old, and in every case, where it has been really necessary for such a work, a competent revising hand is evident. "Chemistry," for example, which was first written twelve years ago, has been brought fairly up to date, and, as chemists know, this implies a great deal. By a few additional sentences in "Astronomy," the direction of the most striking recent researches is indicated; so in "Meteorology" and other articles. Indeed, it is quite evident that the work has been subjected to a thorough revision, and that considerable alterations have been effected, quite sufficient to keep the work fresh until a completely new edition is called for: not a few of the articles have been entirely re-written. The illustrations are copious and, in the main, accurate and well-drawn, and there is an excellent selection of maps.

Of course there are points in the work that are open to criticism; some subjects may seem inadequately treated, and others at too great length, and evidences of local bias are occasionally apparent, while there is a tendency in many of the biographical articles, to ambitious writing and the "higher criticism," which are a little out of place in a staid book of reference. But these are matters of comparatively small importance, in which Dr. Findlater is probably a much better judge than we. Of the sterling merits of the work throughout there can be no mistake, and it will long remain a monument of Messrs. Chambers's enterprise and public spirit, and of Dr. Findlater's practical skill, judiciousnes,s and power of organisation., not to say wide and accurate knowledge. Not its least merit is that, like all Messrs. Chambers's serial works, it was issued in weekly numbers at three-halfpence, and we would advise all who can spare the pittance to become possessed of this "golden treasury" of knowledge.

EGYPT AND THE NILE

Four Thousand Miles of African Travel: a Personal Record of a Journey up the Nile and through the Soudan to the Confines of Central Africa. By Alvan S. Southworth, Secretary of the American Geographical Society. (New York: Baker, Pratt, and Co. London: Sampson Low and Co., 1875.)

MR. SOUTHWORTH, we may at once state, has broken no new ground; he has simply followed what are now considered beaten paths, although fifteen years ago there would have been few European footprints on the route; nevertheless, Mr. Southworth has gathered much useful information. This is given to the public in an agreeable form, with a tinge of American humour in some descriptions that breaks the usual monotony of a book of travels.

It appears that the author's love of adventure prompted him to visit the Soudan in the hope of following and eventually joining the expedition under the command of Sir Samuel Baker, in Central Africa. In Chapter III., "The Start for the Soudan," he writes :—"Alarming rumours of the death of Sir Samuel Baker and his whole party had been freely circulated in Cairo." . . . "Such a great undertaking as the Baker expedition was regarded by many of the finest minds in Egypt as too gigantic to move successfully among the unknown wastes of Ethiopia. In the first place, it is taking an army into a country foul with the unhealthiest malarias, and charred to desert sands by the fiercest of African suns." . . . "Therefore, when news came from Khartoum that Sir Samuel Baker was in distress at some point of the Nile Basin, I prepared to go to the Soudan in order to investigate his position and condition." With this object Mr. Southworth started from Cairo in company with two American officers, Generals Starring and Butler, and after a winter journey through the Korosko Desert, the party arrived in Khartoum on the 6th of February.

Chapter XI. will well repay perusal by those who take a desponding view of Egypt's future. The description given of the extreme fertility and boundless resources of the Soudan may be to a certain extent overdrawn; but even with the deduction of fifty per cent., the value of the country remains enormous. At the period of Mr. Southworth's visit to Khartoum, Moomtaz Pacha was the new Governor-General of the Soudan, a Circassian of great energy, who was determined to develop the cotton-producing powers of his almost boundless territory. Unfortunately he had forgotten that a necessary step preliminary to cultivation was a railway from Cairo, as no means of transport existed beyond the limited conveyance by camels. "Tell the American people," said the Governor-General of the Soudan to Mr. Southworth, "that I have found a new America in the heart of Africa."

"Moomtaz Pacha, who had been there but four months and a half, had done more work than all his predecessors combined. He was the first man who appreciated the resources of this country; who formulated plans to utilise them; and who with a resolute hand began what I am firmly convinced will eventually come to be a prosperous empire, reaching from the equator to the tropic of Capricorn, and from the Indian Ocean to the Desert of Sahara."

Mr. Southworth's evidence is extremely valuable at this moment of general depression, when doubts have been expressed concerning the future prosperity of Egypt. There is the unanimous testimony from numerous travellers that a mine of agricultural wealth lies upon the southern limit of the great Nubian deserts, simply requiring a line of railway for its immediate development. There are lands in many portions of the globe that are adapted by soil and climate for the cultivation of cotton, but in most cases where such facilities exist there is a scarcity of labour. In the Soudan we find not only an apparently boundless extent of fertile soil where the cotton shrub is indigenous, but a large population is at hand who are only too ready to work for a fair remuneration. It may perhaps be forgotten by many that the ancient historian Pliny calls attention to the "wool-bearing trees of Ethiopia." In the days of Herodotus, whose descriptions of Egypt are so graphic, cotton was unknown, and the Egyptians were renowned for the manufacture of the finest linen from the native flax; it was only in the reign of Mehemet Ali Pacha, the grandfather of the present Khedive, that cotton was introduced into Egypt. Curiously enough, this was seed from the "wool-bearing trees of Ethiopia," which was brought into Egypt by an enterprising French traveller upon his return from the Soudan. When we consider the important assistance that was rendered to England by Egypt during the American civil war by an extraordinary effort in the production of cotton, we must feel a more than usual interest in the development of the vast cotton-producing resources of the Soudan. It is the natural hot-bed of the cotton plant, where it has existed from time immemorial; we have only to construct a railway either to the Port of Souakim on the Red Sea, or direct to Cairo according to the plan of Mr. Fowler, and the Soudan will at once deliver its vast burden of riches.

Mr. Southworth upon his arrival at Khartoum discovered that owing to the impediments to navigation caused by the vegetable obstructions on the White Nile, it was quite impossible to carry out his original idea of joining the expedition of Sir Samuel Baker. The enterprising Governor of the Soudan, Moomtaz Pacha, showed him every attention, and invited him to an excursion by steamer up the White Nile. During this voyage Mr. Southworth was struck by the extraordinary fertility of the soil in the vicinity of the river, together with the great advantages of water communication as a means of transport from the interior.

In spite of the vast natural resources of the country, Mr. Southworth, who was now fairly behind the scenes, quickly perceived the moral cancer that preyed upon the Soudan and completely paralysed all progress; this was the slave trade, which engrossed the attention and energies of the population. He writes (page 355): "A slave expedition starting under the title of an ivory enterprise means war. As high as 5,000 soldiers are employed by a single trader. Agāte had over this number on the White Nile; Cushick Ali, 4,000; Gatāse, 4,000; Bizelli, 800. Thus the slave trade in the valley of the Upper Nile is sustained by an active force quite as large as the standing army of the United States." . . . "By examining the most exhaustive consular statistics on the ivory trade, I find that no expedition could pay the first cost. The traders do not expect it; so that when you read of a great ivory trader you may substitute, with little fear of doing an injustice, 'an infamous slave-trader.'" At the time that Mr. Southworth's sympathies were enlisted against this abominable traffic, he thus speaks (page 216) of the Khedive's expedition under Sir Samuel Baker to suppress the slave-hunters: "As long as Baker remained a Pacha at Gondokoro (now Ismailïa) there was no danger of a direct White Nile slave trade. Indeed, the traffic may be said to have been closed." . . . "When I say 'direct slave trade,' I mean no slaves could be made to descend within the reach or knowledge of Baker Pacha. But unhappily he could not cover a whole continent." In page 213 he writes: "Sir Samuel Baker has been in that region its only vigorous European combatant, and more to him than any other man will be due the praise of its utter eradication, if the day ever arrives."

Mr. Southworth, as Secretary of the American Geographical Society, has a perfect right to express his opinions upon the "sources of the Nile," although he did not personally travel far upon the White River. He is somewhat perplexed by the pretensions of Col. Long, who, as a member of Col. Gordon's staff, travelled up to the capital of the King M'Tésé, with whom Sir Samuel Baker had established a permanent alliance. Col. Long, on his return from the Victoria N'yanza Bay, which forms the embouchure of the Victoria Nile exit (discovered by the late Capt. Speke), continued his course down stream by canoe to Foweera, the headquarters of Rionga. He reported that the mighty Victoria N'yanza was only fifteen miles broad, and that Speke had greatly exaggerated the size. He further reported that he had himself discovered an immense lake a few miles south of M'rooli (N. lat. 1° 36′), which he suggested was the "source of the Nile." These pretensions were never accepted by geographers, it being well known that at certain seasons the Victoria Nile floods many leagues of country above M'rooli; this would give a stranger an erroneous impression of a permanent lake. The recent explorations of Mr. Stanley, who claims to have coasted in his boat 1,000 miles of the Victoria N'yanza along the southern, eastern, and northern shores, is a sufficient refutation of Colonel Long's disparaging assertion that Capt. Speke's Victoria N'yanza was only fifteen miles across. Mr. Southworth with true discrimination suggests on page 302: "It is possible that Col. Long's lake was only the Nile in a very swollen condition; for I have seen the Nile at latitude 13° N. at very high water resemble a vast lake." On page 316 Mr. Southworth writes: "Dr. Livingstone's claims may be considered as out of the question. Lieut. Cameron has almost completely proven that Livingstone never saw the Nile, but that his operations were confined to the Congo Basin." On p. 317 the author thus summarises: "It practically reduces the Nile problem to this. The sources must be in the Albert and Victoria N'yanzas or their extensions; in the new lake of Col. Long; at the head waters of the Bahr-el-Ghazal, and in the sources of the feeders of the Blue Nile and the Atbara." We will dismiss the "new lake of Col. Long," but remind Mr. Southworth that he has omitted the most powerful of the White Nile affluents—the Sobat—N. lat. 9° 21′!

There can be no doubt the Victoria N'yanza is a mighty reservoir or principal source of the Nile, and the friends of the lamented Capt. Speke will rejoice in the triumph of his discovery now rendered certain by the survey of Mr. Stanley. The Albert N'yanza has never been visited by any Europeans except Sir Samuel and Lady Baker in February 1864; thus nearly twelve years have elapsed since its discovery, and yet no European has been able to reach its shores, although its waters were again sighted by Sir S. Baker during the expedition of the Khedive of Egypt.

There can be little doubt that Col. Gordon will succeed in exploring the Great Basin of the Nile, which will prove to be not only a source, but the general reservoir or basin that receives all equatorial affluents.

Although Mr. Southworth's travels do not include any new ground, his book affords much useful information, which will be received with more than ordinary interest at the present moment, when Egyptian affairs are prominently before the public.

OUR BOOK SHELF

Discoveries and Inventions of the Nineteenth Century. By Robert Routledge, B.Sc., F.C.S. With numerous Illustrations; pp. 594. (London: George Routledge and Sons, 1876.)

In this book "an attempt has been made to present a popular account of remarkable discoveries and inventions which characterise the present century." "The instances selected have been those which appeared to some extent typical, or those which seemed to have the most direct bearing upon the general progress of the age." "The author has endeavoured to indicate, if not to explain, the principles involved in each discovery and invention."

These extracts from the preface sufficiently explain the object of the work before us. Anyone who attentively reads this book must admit that the author has succeeded in fulfilling the promise of his preface. He has produced a work teeming with useful and exact information presented in a singularly lucid and taking style. Of course this book cannot in any way take the place of the acknowledged manuals on the several subjects of which it treats, but it is admirably adapted to awaken an interest, especially among the young, in those wonderful advances which natural science has made in the present century; and to supply such a general knowledge as shall convey a correct idea of the principles on which the application of science to arts and manufactures are based, along with a sufficiently detailed account of these manufactures themselves.

Books, the general plan of which resembles that of this work, have been too often produced by men who had no scientific knowledge of the processes they attempted to describe, and have therefore shown a lamentable deficiency in exactness of detail and accuracy of theory. That the book before us should have escaped these faults, faults for which no brilliancy of diction or popularity of style can atone, is to be traced to the fact that its author has evidently determined, and has been able to carry out his determination, to make the book a scientific one; to show, as far as could be consistently with the general tone of the work, that theory is necessary for correct practice, and that correct practice reacts upon theory. The contents of the book include an account of steam engines, iron, tools, railways, steam navigation, fire-arms, printing machines, light, the spectroscope, electricity, photography, aquaria, india-rubber, explosives, mineral combustibles, coal gas, &c. A very interesting chapter is devoted to New Metals, in which a clear and succinct account of the discovery and present method of producing sodium, potassium, aluminium, and magnesium is given. The gradual diminution in the cost of these metals, and therefore their increasing application in manufactures as chemical science has discovered easier methods for their preparation, is an argument in favour of the study of pure science which must appeal, one would think, even to the Philistines.

The title which the author has chosen for the closing chapter of his book, viz. "The greatest discovery of the age," might lead one to look for a glowing account of some new invention to economise labour or to annihilate pain, but when we find that the chapter is devoted to a sober account of Dr. Joule's experimental determination of the mechanical equivalent of heat, and to some of the consequences deduced therefrom, we are but the more convinced that this book must rank among the few popular works which are sure to be of service in spreading a knowledge of the incalculable benefits which science has bestowed upon the human race.

M. M. Pattison Muir

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

Scientific Research for the Promotion of Science

In Nature, vol. xii. p. 470, there are some valuable summaries of evidence taken before the Government Science Commission; but among them I was surprised to meet with the statement (by Captain Galton, R.E.) that, as one of the varieties of administration of several existing scientific institutions, "you have the Observatory at Edinburgh as part of the University of Edinburgh."

Now, inasmuch as I have for the last thirty years held the Directorship of the Edinburgh Observatory, by virtue of my appointment thereto signed by her Majesty, I should know something of the real facts of the case; and they oblige me to state that the Royal Observatory (the only Observatory) in Edinburgh is supported, in so far as it exists at all, by Government. It is responsible, moreover, solely to Government, in the person of the Principal Secretary of State for Home Affairs; it has never at any time received a farthing from the University of Edinburgh, whether for instruments, salaries, general maintenance, or particular services; and does not form any part of, nor belong to, nor did ever belong to, the said University in any manner whatever.

But the efficiency of the Observatory has been crippled from the beginning by the connection of its Director with the University; and as that offers a practical answer to the question much discussed in your pp. 429 and 470, touching whether there is, or is not, any difference in kind, nature, interests and feelings between institutions for the promotion of science by original observation on one side, and on the other the usually much larger and more numerous institutions for education,—I trust you will allow me a little space wherein to describe our actual and long-continued experiences here.

Built by the members of the late Astronomical Institution of Edinburgh between 1811 and 1830, this Observatory was, after many public petitions to that end, graciously taken up by Government in 1834, and its future utilisation secured by arrangements for the appointment thereto of a Royal Astronomer with an assistant, and a small allowance for ordinary working expenses. The first Astronomer so appointed was the late Thomas Henderson, the best man by far for such a post whom Scotland has ever possessed; and as he had at that time just returned from being Astronomer Royal at the Cape of Good